

STUDIES IN AUSTRALIAN *NEUROPTERA*.No.6. THE FAMILY *PSYCHOPSIDÆ*, WITH DESCRIPTIONS OF NEW
GENERA AND SPECIES.

BY R. J. TILLYARD, M.A., D.Sc., F.L.S., F.E.S., LINNEAN
MACLEAY FELLOW OF THE SOCIETY IN ZOOLOGY.

(Plates lxxvi.-lxxviii.; and four Text-figures.)

In No.4 of this series of Studies(15, pp.271, 289), I gave my reasons for considering the *Psychopsidæ* to be a separate family, and stated that it was my intention to deal with these insects in a monograph to follow later.

In a paper read in October, 1915(13), but unfortunately not bearing upon it any indication of the actual date of publication, Navás published, in Spain, a monograph of these insects, and classified them as a separate family. This paper has only recently reached me, and I cannot tell whether it should take priority over mine or not; however, in view of the earlier date of reading of Navás' paper, I feel that I must give him the credit of having first raised these insects to family rank.

The conditions arising from the War have made it impossible for me to receive, for study, the material that I had hoped for, in the non-Australian species of this family. For this reason, as well as because of the publication of Navás' paper, I have decided to abandon my projected monograph, and to confine myself mainly to a study of the Australian species. Only in so far as this study affects the classification of the family, will it be necessary to discuss the other genera and species.

During the past three years, a large amount of work has been carried out upon this family. Of special importance has been the working-out in detail of the life-history of one species, *Psychopsis elegans* (Guérin), and the dissection and photographing

of the wings of the pupa, in order to study the tracheation. Including a considerable number of bred specimens of this species, I have had through my hands for study, at one time or another, about one hundred examples of these rare insects, and have thus been enabled to gain a first-hand knowledge of all the Australian species except one. That exception is *Psychopsis meyricki* McLachlan, of which the only known specimens are in the McLachlan Collection, and are, therefore, not available for study.

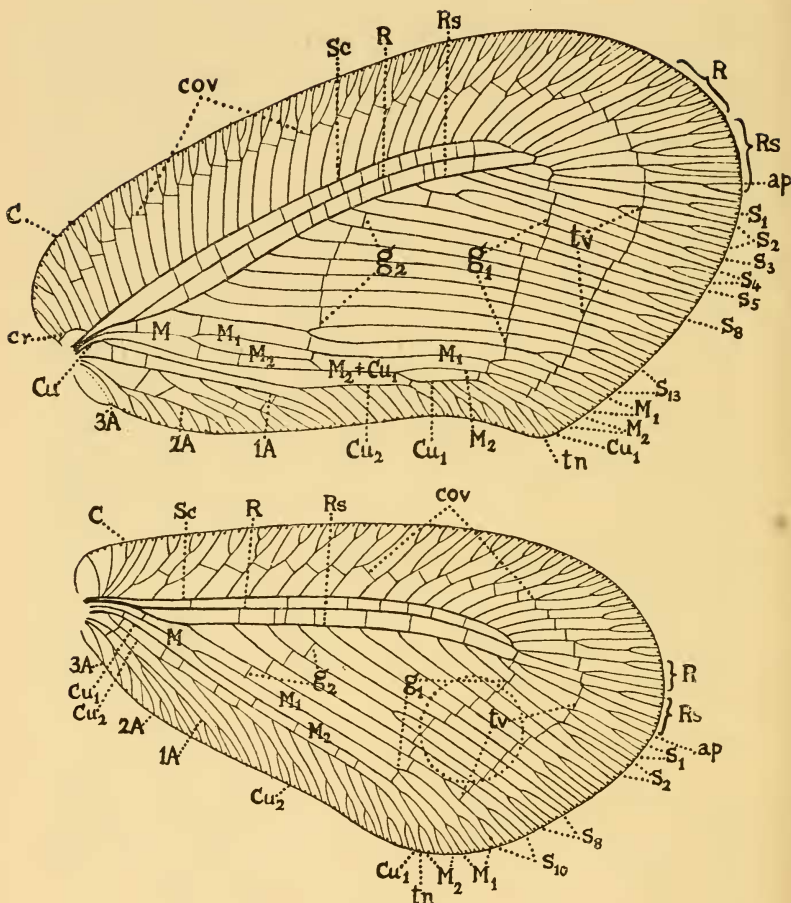
In the present paper, I propose to deal fully with the wing-venation of the family, firstly by a study of the pupal wing-tracheation, and secondly by applying the results so obtained to elucidating the best method of founding genera in the family. This matter is one of considerable difficulty, owing to the essential variability of the characters selected for this purpose by Navás, viz., the amount of cross-venation present. Descriptions of new genera and species will also be included, together with a general discussion of the relationships of the family. The full account of the life-history of *Psychopsis elegans* (Guérin) will form a separate paper, No.7 of this series of Studies.

My thanks are due to Dr. R. Hamlyn Harris, Mr. H. Longman, and Mr. H. Hacker, for the three fine photomicrographs reproduced in Plate lxxvi.

The Venation of *Psychopsis elegans* (Guérin).

In Text-fig. 1, the complete venation of *Psychopsis elegans* (Guérin), is shown. Text-figs. 2, 3A, give, for comparison, portions of the precedent tracheation of the pupal wing, drawn by means of the camera lucida from freshly dissected pupal wings.

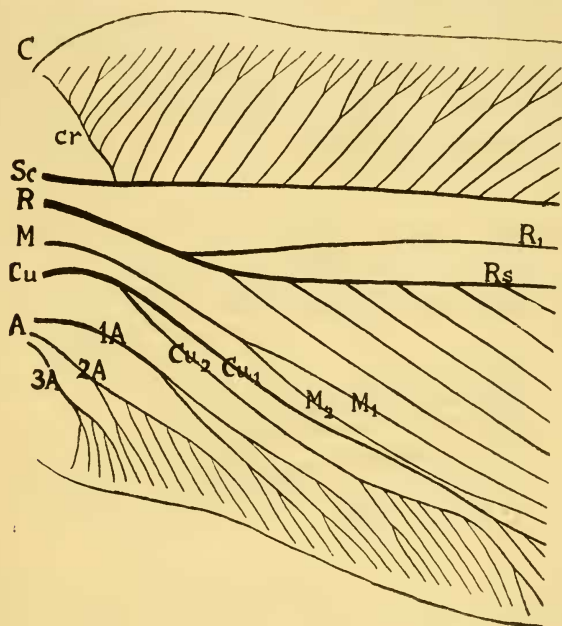
It will be seen at once that, broadly speaking, the venation and the precedent tracheation agree remarkably closely, as is the case with all the more archaic members of the Order Planipennia. Tracheæ precede every main vein, right down to its tiniest branchlets; but no tracheæ precede the cross-veins, which are only lightly indicated on the pupal wing. It is, therefore, very necessary that we should be careful to distinguish between the true *cross-veins* in the imaginal wing, and those *veinlets* (or



Text-fig. 1.

Psychopsis elegans (Guérin). Wing-venation; ($\times 5$). 1A, first analis; 2A, second analis or basilar; 3A, third analis or axillary; *ap*, apex; C, costa; *cov*, costal gradate series of cross-veins; *cr*, recurrent costal or humeral veinlet; Cu, cubitus; Cu₁, Cu₂, its branches; *g*₁, discal gradate series of cross-veins; *g*₂, internal gradate series of cross-veins; M, media; M₁, M₂, its branches; M₂-Cu₁, anastomosed portion of M₂ with Cu₁; R, radius; Rs, radial sector; S₁-S₁₃, its branches; *tn*, tornus; *tv*, terminal gradate series of cross-veins.

branchlets of main veins) which are preceded by tracheæ. For example, the veinlets passing from Sc to the anterior border are true veinlets or branches of Sc; but, in families where they are not so prominently developed as in the *Psychopsidæ*, they are frequently spoken of as cross-veins. The small veins which join these veinlets together, forming a longitudinal series of gradate

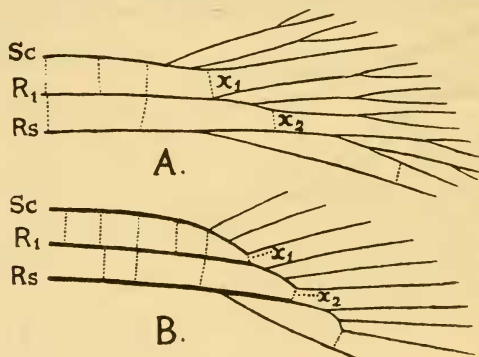


Text-fig. 2.

Psychopsis elegans (Guérin). Tracheation of basal half of pupal wing; ($\times 18$). Lettering as in Text-fig. 1.

veins, are true cross-veins, and are to be regarded as a comparatively late acquisition, correlated with the broadening out of the costal area in this family. So, also, the three other series of gradate veins are true cross-veins, not being preceded by tracheæ. A further point of distinction between veinlets and cross-veins, in this and all other archaic families of Planipennia, is that the veinlets, like the main veins of which they are part, are hairy, whereas the cross-veins are not.

The most striking specialisation in the venation of the *Psychopsidae*, apart from the great enlargement of the costal area, is the manner in which the three parallel main veins, Sc, R, and Rs, have become strengthened, for from two-thirds to three-quarters of their lengths, to form a kind of midrib, from which the rest of the wing, apart from the much reduced median, cubital and anal areas, is supplied with numerous, delicate, radiating veins. I propose to term this strengthened portion of these three veins the *vena triplica*; its distal end is already known as the *anastomosis*. In order to understand this structure, we must consult the precedent tracheation. There (Text-fig.3,A) we



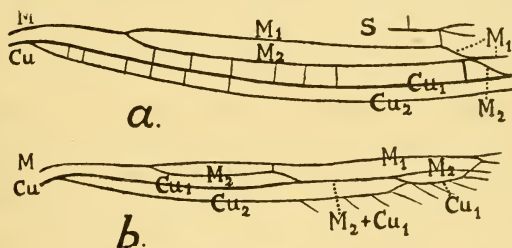
Text-fig.3.

Psychopsis elegans (Guérin). The radial anastomosis in the forewing. A, pupal tracheation; B, imaginal venation; x_1 , x_2 , the two cross-veins which join the distal ends of the vena triplica.

shall find that the tracheæ run normally through the anastomosis, without any thickening basad to it, and without any true anastomosing between them. The strengthening of these veins, from the base to the anastomosis, to form the vena triplica, their apparent unions at the anastomosis, and the strong differentiation of their distal portions so as to appear exactly the same as the branch-veins above and below them, are purely imaginal specialisations, peculiar to this family, and not found elsewhere in the Planipennia. The development of the irregular series of cross-

veins between Sc, R, and Rs may also be correlated with the development of the vena triplica, as an additional strengthening for the midrib.

Let us now study the so-called anastomosis more fully. In Text-fig.3, A and B, I have contrasted the pupal tracheation with the imaginal venation in this region. It will be seen at once that the actual termination of the vena triplica is not accomplished by means of an anastomosis between any of the main veins, but by the interpolation of the two cross-veins, x_1 and x_2 , together with the bending-down of the portions of Sc and R_1 preceding them. We must contrast this strongly with the condition to be seen in the *Osmylidae*, where Sc and R_1 approach one another distally at a very slight angle, and then fuse together, *without the intervention of an auxiliary cross-vein*, for a considerable distance. There is then, in the *Osmylidae*, a true anastomosis between these two veins; whereas, in the *Psychopsidae*,



Text-fig.4.

Types of anastomosis between M and Cu in *Psychopsis*. *a*, usual type in *Ps. mimica* Newman, forewing; *b*, usual type in *Ps. elegans* (Guérin), forewing. In *Ps. insolens* McLach., there is usually no anastomosis in this region at all. Lettering as in Text-fig.1.

there is no true anastomosis, and it would appear to be somewhat misleading to term it so, as Navás has done. However, the term has already been applied, in *Perlaria* and *Trichoptera*, to junctions between main veins, brought about by means of cross-veins in line with one another; so that we may allow it to remain, provided that we understand that we are speaking of a junction of this type, and not a true anastomosis between two or more main veins.

Turning next to the region of the media and cubitus, on the character of which Navás attempts to divide the Australian species from the African, as two separate tribes, on the ground that the former have no anastomosis in this region, the condition to be seen in *Psychopsis elegans* is shown in Text-fig.1 and Text-fig.4, *b*. In the tracheation, M_2 approaches Cu_1 very closely for a considerable distance, and then diverges from it again. In the corresponding venation, M_2 fuses with Cu_1 for this same distance, and the parts of M_2 just before the fusion, and of Cu_1 just after it, are bent so as to appear like oblique cross-veins. It is clear that here we have a *true anastomosis*, comparable with that between Sc and R already mentioned in *Osmylidae*. But this anastomosis is not a constant character, either for the species *elegans* or for the genus *Psychopsis*, as I have noted more fully on p.761. The type of anastomosis in this region in *Psychopsis mimica*, in which, usually, M_1 just anastomoses with M_2 at a point, and M_2 in its turn with Cu_1 , is shown in Text-fig.4, *a*. In other species, such as *Ps. insolens*, there may be, in the majority of specimens, no anastomosis whatever in this region.

The arrangement of the cross-veins, which are not represented in the precedent tracheation, is of great interest. In *Ps. elegans* (Text-fig.1), we note, first of all, the presence of a gradate series closing the disc distally (g_1). This may be termed the *discal gradate series*. Internally to this, and crossing the disc not far from its middle, there is another series (g_2), which may be called the *internal gradate series*. These two series will be at once recognised as the homologues of the two gradate series normally present in the wings of *Chrysopidae*. Besides these, there will be seen a long series of cross-veins connecting the veinlets of the costal space, and extending right from near the base to the apex. This may be termed the *costal gradate series (cov)*. Below the apex, this series is continuous with a gradate series roughly parallel to the discal series, but lying between it and the termen of the wing. This may be called the *terminal gradate series (tv)*. Except for a slight development of costal cross-veins in such genera as *Drepanopteryx*, the costal gradate series does not appear

in any of the lower Planipennia; the terminal gradate series is absolutely peculiar to the *Psychopsidae*.

Of these series, only the discal is invariably present. The internal series is usually present also, but not always. The costal and terminal series are later developments, confined to the larger species, and evidently correlated with the greater expansion of the areas which they help to support. Further, there is great variability in the condition of these series in almost all species. As an example of this, I would point out, in Text-fig. 1, the presence of a single cross-vein in the forewing between the anterior ends of the internal and discal series. This is frequently absent; but, in some specimens, it may be replaced by either half of an extra series, in others by a complete series of as many as thirteen cross-veins, crossing the disc between the internal and the discal series! In one case, I noted the presence of this extra series upon one forewing of a specimen, while it was absent upon the other! It will be at once obvious that attempts to define genera on such variable characters as these, are foredoomed to failure.

In conclusion, it is interesting to note that, regarded as a whole, the wing of *Psychopsis* presents a very close analogy in structure to the feather of the wing of a bird—an analogy which is also suggested by such wings as that of *Drepanopteryx*, but by no means so closely. The vena triplica corresponds with the rachis, forming the main support or midrib in both cases; the position of this support is the same in both cases, viz., nearer to the anterior than to the posterior margin. The numerous veins radiating out from both sides of the vena triplica are the analogues of the barbs of the bird's feather; and the series of connecting cross-veins, or gradate series, are analogues of the barbules, which serve to connect the barbs together.

Classification of the Family.

We are now in a better position to consider the true value of the various venational structures which have so far been used in subdividing it into tribes, and in defining genera.

Our study of the venation shows us that the cross-veins are not preceded by trachea, and that they are to be considered as a later addition to the main scheme of venation. This applies more especially to the costal series of cross-veins and its continuation, the terminal gradate series, which are not fully developed in any other family, and are evidently comparatively recent acquisitions, correlated with the great enlargement of the costal area. With regard to the discal and internal gradate series, it must be evident that variations in the amount and position of the cross-veins forming them will depend partly on the size of the insect, and partly upon the number of branches of the radial sector possessed by it; we should, therefore, be prepared to find a great deal of variation in these characters. If, then, the present system of classification should fail to stand the test that we propose to apply to it, we shall be faced with the problem of finding more reliable characters, on which to rebuild a sounder arrangement of the species.

Though it is not the purpose of this paper to deal exhaustively with the non-Australian species, it will be first of all necessary to call attention to certain errors and omissions in Navás' most recent work. A paper that claims to be a monograph of a family should surely contain a complete bibliography of all the more important papers concerning it, and should also at least list, if not describe, all the known species. But I find that Navás omits from his work all reference to two of McLachlan's most important papers (9, 10), in which that fine entomologist described a new South African species on the one hand, and the only known Burmese species on the other (*Psychopsis marshalli* McL., and *Ps. birmana* McL., respectively). Consequently, Navás gives only four species instead of five for South Africa (unless, indeed, one of his own species is synonymous with McLachlan's!), and is quite unaware that a Burmese species exists at all! As there are only fifteen species known altogether, it will be seen that these omissions are very serious for a monograph.

We must now note some further errors of equal gravity. In 1910, Navás described specimens of *Psychopsis elegans* (Guérin),

surely one of the best known and most typical species of the family, as a new genus and species of *Hemerobiidae*, under the name *Zygophlebius verreauxinus* Navás(11). The description clearly shows that, at the time, Navás was quite unaware that there was such a genus as *Psychopsis*, though it had been proposed nearly seventy years before, and its type-species was one of the most striking of all known Planipennia. Later in the same year, N. Banks(1) pointed out that *Zygophlebius* was clearly synonymous with *Psychopsis*; whereupon, in his next publication, Navás suppressed his generic name in favour of *Psychopsis*. If he had stopped there, all would have been well. But, in his monograph(13), he proceeded to resurrect Guérin's old generic name *Arteriopteryx* (given by that author in ignorance of Newman's then quite recently published name, *Psychopsis*), the type of which is *elegans* Guérin, synonymous with *verreauxinus* Navás. He then, quite illegally, further resurrects his generic name *Zygophlebius*, of which the original type was *verreauxinus* Navás (= *elegans* Guérin), and proceeds to redefine it, and to give it a new genotype, *Psychopsis zebra* Brauer, from South Africa. At the same time, he forms the tribe *Zygophlebini* to receive the whole of the South African species, leaving *elegans* Guérin, together with all the other Australian species, in the tribe *Psychopsini*!

Now *Zygophlebius* was proposed by Navás as a monotypic genus, and hence there can be no question as to which species was its type. Hence, whether Navás was correct in placing that species in *Psychopsis*, as he did in 1912, or in *Arteriopteryx*, as he did in 1916, is immaterial to the question. In either case, *Zygophlebius* sinks as a synonym, either of *Psychopsis* Newman, or of *Arteriopteryx* Guérin. As a *nomen nudum*, it may not again be resurrected in the form of a new genus, to receive, as its type, another species of *Psychopsis*, viz., *Ps. zebra* Brauer. Further, the tribal name *Zygophlebini* must sink with it. If *Ps. zebra* Brauer, is really generically distinct from *Ps. nimica* Newman, it now requires a new name. I therefore propose the name *Notopsychops*, n.n., to replace *Zygophlebius* Navás, 1916,

(type *zebra* Br.), invalidated by *Zygophlebius* Navás, 1910, (type *verrauxinus* Navás = *elegans* Guérin) itself a synonym for *Arteriapteryx* Guérin, synonymous with *Psychopsis* Newman.

Having thus cleared the ground to some extent, let us now pass to the consideration of the division of the family into tribes, as proposed by Navás in 1916 (13, p.188). I give herewith his key, translated from the original Spanish:—

- | | | |
|-----|---|---|
| (1) | { | Costal area of both wings divided, at least partly, by a median longitudinal series of gradate veinlets (<i>venillas en escalinata</i>) 2. |
| | | Costal area simple or totally undivided in both wings. Asiatic species 3. <i>Balmesini</i> , nov. |
| (2) | { | Two anastomoses in both wings; the anterior formed by the subcostal, the radius and its sector, which are united in the region of the stigma, the posterior by the proclivus (=M), the cubitus and its sector, which are connected in a similar manner. African species..... 2. <i>Zygophlebini</i> Navás, restr. |
| | | One evident anastomosis, viz., the anterior or radial, formed by the three veins mentioned; the others run parallel without bending manifestly in an anastomosis. Australian species...
..... 1. <i>Psychopsini</i> , nov. |

In his description of *Psychopsis birmana*(9), which Navás has evidently not seen, McLachlan says:—"It differs from all Australian species except *Ps. meyricki* in the absence of a line of oblique connecting nervules in the costal area"; and, lower down, he divides the known species of *Psychopsis* into two groups, of which the first, consisting of *Ps. meyricki* and *Ps. birmana*, is defined by the words "No line of oblique nervules in costal area, only two series of transverse gradate veins."

The facts of the case are that *Ps. meyricki* normally lacks the costal series of cross-veins, as McLachlan here states. Navás, however, who admits that he has never seen this species, is compelled to place it in his genus *Magallanes*, together with *Ps. insolens* McLach., though he defines this genus as having the costal space of the forewing subdivided by the presence of the series of costal cross-veins, which *Ps. meyricki* lacks. For, if he had anywhere mentioned this character, which McLachlan emphasises, his tribe *Balmesini* at once breaks down!

Here, then, we have an instance of an entirely artificial subdivision into two tribes, *Balmesini* and *Psychopsini*. We may well ask, what is the essential point in the subdivision? Is it to divide the Asiatic from the Australian species? If so, then the division on the character of the costal space breaks down, and *Ps. meyricki*, agreeing with the Asiatic species in this respect, must nevertheless stand apart from them in the tribal division. But if it is the character of the costal cross-veins that is the essential matter, the case becomes even worse; for then the Australian species *Ps. meyricki* must at once be removed from the tribe *Psychopsini* to the tribe *Balmesini* (all the rest of which are Asiatic species), and must also be removed from the genus *Magallanes*, of which its close ally, *Ps. insolens* McL., is the genotype, and find its proper place in the Asiatic genus *Balmes*!

There is only one escape from this dilemma, and that is, to admit that the tribal characters here under discussion are of no value, and to suppress the tribe *Balmesini* altogether.

Turning next to the characters of the tribe *Zygophlebini* Navás, as here defined, it is only necessary to draw attention to my remarks on the condition of the venation of *Psychopsis elegans* in the region of M and Cu (p.756). Navás' definition for the tribe *Zygophlebini* indicates the presence of an anastomosis in the region of these two veins for this tribe, but the absence of the same anastomosis in the tribe *Psychopsini*. One would have little hesitation in deciding that both *Psychopsis mimica* Newman, and *Ps. elegans* Guérin, must go into the tribe *Zygophlebini*, on this definition. Whether the form of anastomosis is the same in these species as it is in the African ones, I am not able to say; the point is, that the amount of anastomosis in this region is very variable, not only for different species, but also for different individuals of the same species. There is only one species known to me, viz., *Ps. insolens* McL., in which it can truly be said that the great majority of the known individuals have no anastomosis in this region; hence, strictly speaking, this is the only species that can be rightly admitted into the tribe

Psychopsini, as defined by Navás. Thus we come to a *reductio ad absurdum*, which it is not necessary to pursue any further. The only remedy is to admit, at once, that the tribal characters under discussion are of no value, and to suppress the tribe *Zygo-phlebini* altogether. We are then left with only the tribal name *Psychopsini*, which ceases to have any value as restricted by Navás' definition, and may be disregarded; leaving us with a single family of closely united species, the *Psychopsidæ*, within which no legitimate tribal divisions can so far be recognised.

Having settled these questions, we may now proceed to define the family *Psychopsidæ* afresh, and to deal more fully with the Australian genera and species. This will necessitate a discussion of the validity of the genera proposed by Navás for the Australian species, a re-grouping of the species, and descriptions of two new genera and species.

Family PSYCHOPSIDÆ.

Head: size small or medium; *eyes* large and rounded, well separated, projecting laterally; *ocelli* absent or vestigial; *antennæ* short, set fairly close together, many-jointed. *Mandibles* small, with only a single internal tooth below apex; *maxille* with five-jointed palpi; labial palpi three-jointed.

Thorax: broad and strongly built; *prothorax* short and comparatively narrow; *mesothorax* very broad and large; *metathorax* also broad, much shorter than mesothorax, and not fused with it. *Legs* short, the tibiæ with a pair of terminal spurs, the tarsi five-jointed, with small terminal claws and a broad empodium.

Wings very broad, with broadly rounded apices. Costal space excessively widened from base to apex without any differentiated pterostigma; the costal veinlets numerous and frequently branched, generally connected by a more or less complete series of longitudinal cross-veins (absent or reduced in the smaller species); a recurrent vein at the base of the costal space. Sc, R, and Rs are strong veins, and run closely parallel, forming a strong midrib to the wing, the *vena triplica*, supported by numerous cross-veins; this formation ends at a point between one-quarter

and one-third of the length of the wing from the apex, where Sc, R, and Rs become joined by strong cross-veins, forming the *anastomosis*; from this point onwards, these three veins continue only as weak branching veins, indistinguishable from those around them. Branches of Rs very numerous, closely parallel to one another, their direction almost parallel with that of the dorsal border of the wing. Central area of wing marked off as a *disc*, bounded anteriorly by Rs, posteriorly by Cu, and distally by a series of gradate cross-veins, the *discal series*. Other series of gradate cross-veins may also be developed; in particular, an *internal series* crossing the disc near its middle, and a *terminal series*, lying between the discal and the termen, and continuing the line of the costal cross-veins; apart from these, there is little or no development of cross-veins upon the wing. M variable, but always with its branches closely parallel, and occupying only a little of the wing-space. Cu either two-branched or simple, with or without a variable amount of anastomosis with M. Anal veins short, three in number, mostly much branched.

A b d o m e n short, moderately stout, completely covered by the wings in the position of rest. *Appendages* variable, usually either forcipate or valve-like in the males.

E g g s oval, with rounded ends; laid separately and attached by one side.

L a r v a very distinct on account of its large, squarish head, from which the enormous jaws project like a pair of calipers; mandibles without internal teeth; the body somewhat flattened, of moderate width, fairly long, tapering posteriorly to the anal sucker; the legs short and formed for running backwards. Colouration greyish-brown, with pruinescence. Inhabits crevices in the bark of large forest-trees; fiercely carnivorous.

C o c c o o n spherical, or nearly so, resembling a large pearl; spun from the anus, of fine cream-coloured silk, in crevices of the bark.

P u p a short and stout, of normal Planipennian form. Active at metamorphosis, when it cuts open the cocoon and ascends the tree for some distance before disclosing the imago.

(A full account of the egg, larva, and pupa will be given in dealing with the Life-History of *Psychopsis elegans* Guér., which will form the next of this series of Studies).

Distribution: Australia (but not Tasmania), South Africa, Burma, Thibet, and China; suggesting a Gondwanaland origin for the family. Close relatives of the family were present in the Trias of Ipswich, Q.

The *Psychopsidae* are at once distinguished from all other Planipennia by their shortened antennæ, the joints of which remain distinct and similar, and by their remarkable wing-structure, in which the most striking characters are the great enlargement of the costal area, with formation of the connecting costal cross-veins; the strengthening of Sc, R, and Rs to form the *vena triplica*, supported by cross-veins between them; the strong differentiation between the vena triplica and the parts of Sc, R, and Rs lying beyond the anastomosis; the formation of the anastomosis by interpolation of two small cross-veins; and the great abundance and closeness of the branches of Rs.

As regards the definitions of the four Australian genera, I give herewith Navás' key to them (13, p.188), translated from the original Spanish:—

- | | |
|-----|--|
| (1) | { Forewing with four transverse series of gradate veinlets, three in the disc and one the external continuation of the costal series; hindwing with only three such series, two discal and the external one which continues that of the costal field parallel to the external margin of the wing... 1. <i>PSYCHOPSIS</i> Newman.
Forewing with only three series of transverse veinlets..... 2. |
| | |
| (3) | { Three transverse series of gradate veinlets, very distinct and complete, in forewing; only two in hindwing... 3. <i>WERNZIA</i> Navás.
Disc of forewing with two complete series of gradate veinlets, at times a trace of a third in continuation of the costal series; hindwing with only one 4. <i>MAGALLANES</i> Navás. |

According to Navás, the arrangement of the gradate series

shown in Text-fig.1, determines the insect as belonging to the genus *Arteriopteryx* Guér. If, however, the forewing has an extra series interpolated in the disc, between the internal and discal series, then the insect belongs to *Psychopsis* Newman. If the arrangement for the forewing remains as in Text-fig.1, but the hindwing has one series missing, then the insect goes into *Wernzia* Navás. If, in addition to this, the terminal series in the forewing is absent, or only partially formed, then the insect belongs to *Magallanes* Navás.

A complete study of the whole of the cross-veins in the specimens in my collection has been carefully carried out. The total number of specimens studied was sixty-four; but many of these have since been given away or exchanged. They represent eight species, two of which are new. The following very interesting and instructive results are here given:—

Psychopsis illidgei Froggatt.—The male in my collection has three complete series in all four wings. In the forewings, there are numerous scattered cross-veins in the upper distal portion of the disc (Plate lxxvii., fig.4), but no sign whatever of a fourth series between g_1 and g_2 . Hence, according to Navás, this insect belongs to *Arteriopteryx* Guér.

In a large female of the same species, which I examined in the Queensland Museum, and of which photographs are given in Plate lxxvi., figs.1-3, there are only three series in the forewings, and no irregularly placed cross-veins elsewhere in the disc. This specimen, then, also goes into *Arteriopteryx*, according to Navás.

Of two specimens in Mr. Froggatt's Collection, one has three complete series of gradate cross-veins in all four wings. The other has four complete series on the left forewing, and only three on the right. Hence, according to Navás, the first specimen belongs to *Arteriopteryx*, the second partly to that genus and partly to *Psychopsis*!

Psychopsis mimica Newman.—I have examined seven specimens altogether. The forewing shows also three complete series; in addition, there are a variable number of cross-veins in the

disc, between g_1 and g_2 , numbering from four to thirteen. In only one specimen do these form a complete fourth series; in the rest, they form either an incomplete series, or are just scattered irregularly. In the hindwing, the terminal and discal series are complete, but the internal series is very variable, being sometimes complete, and sometimes very incomplete, with as few as seven veins in it.

This is the type-species of the genus *Psychopsis*. Of the seven specimens examined by me, Navás would place only one definitely within *Psychopsis*; the rest are either intermediate between *Psychopsis* and *Arteriopteryx*, or between *Psychopsis* and *Wernzia*.

Psychopsis gracilis, n.sp., (Plate lxxviii., fig. 10).—The only known specimen shows the three series of the forewing complete, together with a very irregular, incomplete fourth series in the disc between g_1 and g_2 . In the hindwing, the discal and terminal series are practically complete, but the internal series consists of only four cross-veins, not forming a continuous series, and not close together in line. One would like to know where Navás would place this specimen.

Psychopsis elegans (Guér.), (= *Ps. newmani* Froggatt).—Twenty-eight specimens of this species have been examined, most of them bred specimens. The cross-venation is very variable. In the forewing, the three series are always complete; but there may or may not be a fourth. In some specimens, this fourth series is complete, consisting of as many as thirteen veins in line; in others, there is only half a series; in others again, only three or four irregular veins; while, in the majority of specimens, there is only one intermediate cross-vein (as in Text-fig. 1), or none at all. I have seen one specimen having four complete series in one wing, and only three in the other! In the hindwing, the terminal and discal series are always complete, but the internal series is very variable, being sometimes a complete series of from eight to ten veins in line, and sometimes merely from three to five irregularly placed cross-veins. Thus, different specimens of this species might almost be placed in three of Navás' genera, and we are not surprised to find this author himself placing

elegans in *Arteriopteryx*, and *newmani* in *Psychopsis*, although they are one and the same species!!

Psychopsis calivagus (Walker).—Five specimens have been examined. The forewing has the terminal and discal series complete, the internal series either complete or incomplete. In the hindwing, the internal series is absent, the terminal series is complete, and the discal series is very variable. It may be complete and in normal position, or it may be removed inwards to a position midway between the normal positions of the discal and internal series, or it may be entirely replaced by irregular cross-veins; in one specimen, the disc is covered nearly all over by irregular cross-veins, not forming any gradate series at all. This variability should be contrasted with Navás' definition of the genus *Werezia*, of which this species is the genotype.

Psychopsis insolens Walker.—Twenty-one specimens have been examined. In this species, the forewing has the discal series complete, the internal either complete or nearly so. The terminal series is usually quite absent; but, in some cases, there are from one to five cross-veins belonging to the upper end of this series. In the hindwing, the discal series is complete, the internal series very variable. Normally either absent or represented by only one cross-vein, it is nevertheless present in a fair percentage of specimens, either as an incomplete series of two or three veins, or as a complete series of four consecutive veins; further, right and left wings do not always show the same condition. The terminal series is absent in the hindwings; and the costal series, which is complete in both wings of all the preceding species, is here reduced to a shorter series, running from the base outwards for a variable distance, from one-third to two-thirds the entire length of the costal area. Thus we see that Navás' definition of the genus *Magallanes*, of which this species is the genotype, will not include the whole of the specimens examined.

Finally, in a single specimen of a new species (Plate lxxviii., fig.11), which will form the type of a new genus, we find the discal and internal series present on both fore- and hindwings, the discal series of the hindwings being not quite complete, and

removed somewhat inwards from the normal position. The marginal series is absent from both wings, and there is only a mere vestige of the costal series, at the base of the wing.

(*Psychopsis meyricki* McLachlan, which I have not seen, is stated by its describer to have both discal and internal series present in the forewing; but nothing is said as to the condition of the hindwing; the costal series is absent).

Reviewing the above evidence, it is clear that:—

(1) The genus *Psychopsis* Newman, being founded upon *Ps. mimica* Newman, a species which itself shows great variability in the number of its series of cross-veins, cannot be restricted by any definition which attempts to limit this variability.

(2) The genus *Arteriopteryx* Guér., founded upon *Ps. elegans* Guér., a species very closely allied to *Ps. mimica*, and with almost equally variable cross-venation, must be suppressed entirely, and its type-species retained within *Psychopsis* Newman.

(3) The genus *Wernzia*, as defined by Navás, does not even include all the specimens of its type-species. If, however, the definition of the genus be widened, then it at once forms a part of the *Psychopsis*-series of species, and should be included in that genus.

(4) The genus *Magallanes* is founded upon a type-species which grades into *Wernzia* in the characters of some of its individual members. This should also, therefore, be removed back to *Psychopsis*.

If these conclusions be accepted, the genus *Psychopsis* will include forms showing a gradual transition, from four series to two in the forewing, and from three series to one in the hind, with scarcely a break anywhere in the series. Bearing in mind that the gradations are not specific constants, but essentially of individual value only, it must be evident that any attempt to subdivide this genus, upon the basis of these variable characters, is bound to fail.

We have, therefore, to ask whether we should be content to leave all the Australian species in the genus *Psychopsis*, or whether we should seek for some new division.

I believe that a natural division of the Australian species is possible, without attempting to make use of characters so essentially variable as the cross-venation. Anyone who has studied these insects at all fully will be at once struck with the very great difference exhibited between *Psychopsis illidgei* Froggatt, and all the other species. This may be seen at once by comparing Plate lxxvii., fig.4, with Text-fig.1 and Plate lxxviii., fig. 10. Apart from its much greater size, *Ps. illidgei* differs from all the other species by the shape of the wings, in which (but more especially in the forewing), the dorsal margin is strongly excavated, so that the tornus projects very prominently beyond the rest of the wing-area. This species is also unique in possessing raised or embossed areas upon the forewing. Further, there is a great difference in the venation, in that the branches of the radial sector are far more numerous and closely set in this species than in any other, giving the wings the appearance of having been made from spun silk or some other fine material. Finally, if we examine the condition of the median vein, we shall find that it has from four to six branches within the disc; whereas, in all the other species, it is only two-branched. These differences are so striking, that I have no hesitation in separating out *Ps. illidgei* from the other species of the genus, to form the type of a new genus *Megapsychops*, whose full definition will be found below.

All the Australian species left over in the genus *Psychopsis* agree in possessing a moderate number of branches of the radial sector, in having a hindwing about two-thirds as wide as the fore, and with a very characteristic, dark, round spot upon it, towards the apex. But I have, in my collection, a small new species, in which the hindwing is much narrower, being only about half as wide as the forewing, and the dark spot is absent. Though these characters do not separate this species so distinctly from the rest as do those of *Ps. illidgei*, yet they have the merit of being obviously constants. Hence I propose to describe this new species under a new generic name, *Psychopsella*, of which it will form the type. The full definition of this genus is given below.

There now remain within the genus *Psychopsis* the six Australian species *mimica* Newman, *gracilis*, n.sp., *elegans* Guér., *calirayus* Walker, *insolens* Walker, and *meyricki* McLach. Of these, the first three are distinguished by their usually larger size, the somewhat angulated tornus of the wings, and the pink or red colouration of the markings above the tornus of the forewing. Contrasted with these, the other three are usually of smaller size, with more rounded wings, the tornus not prominent, and the colouration either fawn, brown, or black. It would appear at first sight that these two groups suggest a natural division of the genus into two. But, unfortunately, the species *elegans* Guér., is so variable that it forms a connecting link between the two groups. I have a number of specimens that are no larger than well-sized examples of *Ps. insolens*; moreover, the smaller the specimen, the more rounded does the wing become; so that my series of *elegans* offers almost a complete transition from the angulated tornus, seen in *mimica*, to the rounded tornus of *insolens*. There remains, therefore, nothing but the colour to go upon. The only conclusion I can legitimately come to is, that these six species form a natural assemblage, which is best expressed as a single genus. But, having said that, it should also be remarked that all six species are very distinct forms, and there is no difficulty whatever in separating them at sight. A key to these species will be found below.

Key to the Australian Genera.

- | | | | |
|-----|---|--|----|
| (1) | { | Ocelli vestigial. Fore and hindwings of almost equal width, with the branches of Rs excessively numerous (27 to 32 in forewing, 18 to 24 in hind), exceedingly close together, so as to give the wing the appearance of the close texture of spun silk; dorsal margin strongly excavated before the tornus, the latter very prominent, especially in the forewing. M at least four-branched. Forewings with raised or embossed areas.... | |
| | | MEGAPSYCHOPS, n.g. (Type, <i>Psychopsis illidgei</i> Froggatt). | |
| | | Ocelli absent. Hindwing distinctly narrower than fore. Branches of Rs moderately numerous (from 7 to 16), not excessively close together; M only two-branched; dorsal margin straight or only slightly excavated; no raised or embossed areas on forewing..... | 2. |

- (2) { Hindwing about two-thirds as broad as forewing; and with a distinct dark rounded spot towards apex or termen.....
 PSYCHOPSIS Newman.
 Hindwing only just over one-half as wide as forewing, and without any such spot
 PSYCHOPSELLA, n.g. (Type, *Psychopsella gallardi*, n.g. et sp.).

MEGAPSYCHOPS, n.g. (Plates lxxvi., lxxvii.).

Characters as given above. Large insects, expanse over 50 mm.

Genotype, *Psychopsis illidgei* Froggatt.

MEGAPSYCHOPS ILLIDGEI (Froggatt). (Plates lxxvi., lxxvii.).

Psychopsis illidgei Froggatt, These Proceedings, 1903, xxviii., p.455, Pl. xxi., figs.7, 9. Navás, Congreso de Valladolid, 1916, p.191, fig.2.

There is no need to add very much to the excellent description given by Froggatt. The insect is so distinct and remarkable, that it cannot fail to be recognised at sight.

Hab.—Mount Tambourine, South Queensland; 1,900 feet. Exceedingly rare, only five specimens having been taken during twenty years, all attracted to light.

Plate lxxvi., fig.2, is a very fine photograph of the magnificent specimen in the galleries of the Queensland Museum. This specimen is an exceptionally large female. Plate lxxvi., figs.1, 3, show the venation of the fore- and hindwings of the same specimen.

Plate lxxvii., fig.4, shows the venation of the small male in my collection. This is apparently the only known male of this species. A short description of the points in which it differs from the female is here given:—

Total length, 13.5 mm.; *forewing*, 26 mm.; *hindwing*, 22 mm.; *expanse*, 54.5 mm. Colouration not quite as dark as in female; the spots near tornus of hindwings pale and semi-transparent.

Abdomen very short, only 7.5 mm. long, narrowed at base, but much swollen anally. *Appendages* consisting of a pair of superior and a pair of inferior, broadly triangular, valve-like

laminae, forming a pyramid, which almost completely hides the end of the abdomen from view (Plate lxxvii., fig.5).

Type, in Coll. Froggatt.

As the extinction of this fine insect would seem to be only a matter of a few years, owing to the gradual clearing of the mountain which is its only known home, the following account of its habits and resting position, taken from notes supplied by Miss M. Davidson, of Cedar Cottage, Mount Tambourine, will be of considerable interest to all entomologists. The figures given on Plate lxxvii., figs.6-7, were drawn from pencil-sketches of the living insect made by Miss Davidson.

At rest, the position of the wings depends upon the kind of surface on which the insect is placed. When, as usual, it rests upon the bark of a tree, or some fairly wide and flat surface, the wings are held roof-wise over the body, but inclined wide apart, at an obtuse angle, as is shown in Plate lxxvii., fig.6. In this position, the resemblance to a Reptilian head is very striking, as is also said to be the case with the gigantic Hepialid, *Leto staceyi* Scott. Both insects have the embossed area in much the same position, resembling a pair of wide-open eyes. But, in *Megapsychops*, there is the additional suggestion of the forwardly projecting snout, formed by the coalescence of two dorsal bands right up to the head.

The local name for this insect on Mount Tambourine is, as I am informed by Mr. W. H. Davidson, the "Cross-bones." This would appear to have been suggested by the resemblance of the transverse band on the forewing, with its somewhat narrow stalk, terminated at either end by an enlarged embossment, to the crossed femoral bones in the traditional pirate's emblem of the "skull and cross-bones."

When resting on a twig, the wings are brought closer together, so as to form a steep roof over the body, as may be seen in Plate lxxvii., fig.7. The head is almost completely retracted, and the antennae folded beneath it out of sight. At night-time, when the insect becomes active, or when feeding, the head is protruded and raised up, while the antennae are held almost vertically upwards.

In either position of rest, Miss Davidson states that the resemblance of the insect to a moderate-sized fungus is very marked. Certainly, the white colour of the wings, with their yellowish-brown markings, would suggest this; but I do not know whether there is actually any fungus growing on the mountain for which the insect might be readily mistaken. Unless there is, we cannot say that the appearance of the insect is such as to afford it readily any protection from birds. From the fact that its wings have been seen several times lying upon the ground, the insect having evidently been seized and eaten by a bird, and also that Mr. Davidson himself lost a fine female from his verandah, through a bird seizing it, there would seem to be *prima facie* evidence that its appearance affords it no protection whatever. Birds may, therefore, have been one of the main factors in the reduction of the *Psychopsidae* to a mere remnant since Jurassic times, and also in the total extinction of their Jurassic allies, the *Prohemerobiidae* and the gigantic *Kalligrammatidae*.

Miss Davidson's sketches were made from the specimen in my collection, which was captured on Dec. 7th, 1916, and was kept alive for about a fortnight on sugar and water, in the hope that it might lay some eggs. Unfortunately, it proved to be a male. A fine female, which was apparently attracted to it one night, was seen in the early morning resting upon the verandah; but, as already recorded, was seized and carried off by a bird, before Mr. Davidson could secure it.

PSYCHOPSIS Newman.

Newman, Entomologist, 1842, p.415. Hagen, Stett. ent. Zeit. 1867, p.375.

Arteriopteryx Guérin, Iconographie du Règne Animal, 1845, iii., p.389.

Arteriopteryx (partim) Navás, Congr. Valladolid, 1916, p.189.

Zygophlebius Navás, Broteria Braga, 1910, p.82.

Wernzia (partim) Navás, Mem. R. Acad. Ci. Art., Barcelona, 1912, x., p.195.

Magallanes (partim), Navás, Mem. R. Acad. Ci. Art., Barcelona, 1912, x., p.197.

Characters as given in the key on p.771, with the following additions:—Moderate-sized insects, expanse varying from 25 to 50 mm.; with or without anastomosis between M and Cu in forewing.

Genotype, *Psychopsis mimica* Newman.

With regard to the variable character of the amount of anastomosis between M and Cu in forewing, Text-fig.4 shows two of the variable conditions to be found in the genus. In the type-species, *Ps. mimica*, the most frequent condition is that shown in Text-fig.4*a*; but a condition resembling that shown in *b* may also occur in one or both wings. In *Ps. elegans*, the commonest condition is that shown in *b*, but there are many irregularities in one or both wings. In *Ps. coelivagus*, either of the two conditions shown in *a* and *b* may be present, or the anastomosis may be complicated by the presence of numerous cross-veins, or there may be no anastomosis at all; this last condition is the most usual one for *Ps. insolens*.

Not having seen any of the African species, I cannot say whether the type of anastomosis on which Navás bases his separation of these species, as a tribe separate from the Australian ones, is of the type here shown or not; but, as he qualifies his statement that M, Cu and its sector (by which, I presume, he means Cu₂) are anastomosed, by the phrase "magis vel minus sensibili" (13, p.199), I anticipate that here, as almost everywhere else, he has failed to select a constant character for his subdivision, and that a thorough revision of the African species will result in the complete collapse of his tribal distinctions.

Key to the Species of *Psychopsis*.

- | | | |
|-----|---|--|
| (1) | { | Larger species, expanse 33 to 50 mm., with definite, transverse fasciæ in forewing, and pink or red markings near tornus; forewing with more or less prominent tornus. Dark spot on hindwing placed well <i>below</i> the anastomosis of Sc, R, and Rs. 2. |
| | | Smaller species, expanse 25 to 36 mm., with tessellated, fawn-coloured, grey or black markings on forewing; tornus well rounded. Dark spot of hindwing placed either upon the anastomosis itself, or between it and the apex 4. |

- (2) { Fasciæ of forewing very distinct; no blood-red patch situated about one-fourth of the wing length from the base..... 3.
 Fasciæ less distinct; a blood-red patch on forewing, at about one-fourth of the wing-length from base *Ps. elegans* (Guér.).
- (3) { Two very distinct and well separated black spots, of moderate size, situated near tornus of forewing; at least five transverse fasciæ, of which the first ends in a dark blotch overlying Sc, R, and Rs at about one-fourth of the wing-length from the base, while the last three converge towards the tornus.....
 *Ps. mimica* Newman.
 Two very minute black spots close together at tornus of forewing; only four transverse fasciæ, of which the first completely crosses the wing to the dorsum, while the third and fourth converge to meet above the tornus.....*Ps. gracilis*, n.sp.
- (4) { Spot of hindwing covering the anastomosis..... 5.
 Spot of hindwing placed about half-way between anastomosis and apex; colouration of forewing yellowish-brown or fawn-colour... .. *Ps. insolens* McLach.
- (5) { Forewing heavily marked with black; spot of hindwing black... ..
 *Ps. caliragus* (Walker).
 Forewing tessellated with pale grey; spot of hindwing pale fuscous..... *Ps. meyricki* McLach.

PSYCHOPSIS MIMICA Newman.

Newman, Entomologist, 1842, p.415.

Froggatt, These Proceedings, 1903, xxviii., p.454, Pl. xxi., figs. 3-5 (nec *Psychopsis mimica* Froggatt, These Proceedings, 1902, xxvii., p 367).

Navás, Congr. Valladolid, 1915, p.190, fig.1.

Hemerobius mimicus Walker, Cat. Neuroptera Brit. Museum, 1853, p.279.

Type, in British Museum.

This is the most widely distributed of all the known species, but by no means the commonest. I have seen specimens from several localities in the south-west of Western Australia, from South Australia (including several taken at light in Adelaide), from Victoria, and from the western parts of New South Wales. Along the coastal strip of New South Wales, it is replaced by *Ps. elegans*; but it reaches the coast again around Brisbane, Q.,

where a number have been taken at electric lights. I know of no record further north than this.

PSYCHOPSIS GRACILIS, n.sp. (Plate lxxviii., fig.10).

♂ *Total length*, 11 mm.; *abdomen*, 5.5 mm.; *forewing*, 20.5 mm.; *hindwing*, 17.5 mm.; *expanse*, 42.5 mm.

Head pale brownish in colour, 1.8 mm. wide, *eyes* black, *antennae* pale ochreous, 4 mm. long.

Thorax: *prothorax* pale ochreous, 0.6 mm. long by 1.2 mm. wide. *Pterothorax* pale ochreous anteriorly, shading to dark greyish-brown behind, irregularly marked with brown blotches; greatest width 2 mm. *Legs* very short, very pale ochreous in colour, slightly darker on tibiae and tarsi.

Wings with a general resemblance to those of *Ps. mimica*, but much more transparent, more delicately built, and less hairy. If placed upon a dark background, the wings of *Ps. mimica* appear white, with their pattern of dark fasciæ and other markings showing up very distinctly; those of *Ps. gracilis*, on the other hand, are very transparent, so that neither the venation nor the colour-pattern shows up well under these conditions. Forewings more triangular in shape than those of *Ps. mimica*, more narrowed towards the base, and slightly wider at the level of the tornus. Only four distinct transverse fasciæ, of which the first two are only lightly indicated in the costal area (those of *Ps. mimica* are most strongly marked in this area); the most basal fascia runs as a slight arc from Sc to the dorsum, at about one-fourth of the wing-length from the base; the second is incomplete, and passes from Sc transversely only half-way across the disc, a little basal of the middle of the wing; the third is well marked on the costal area, slightly broken as it approaches Sc, then well marked as it passes downwards, somewhat obliquely, to meet the fourth above the tornus; the fourth fascia is also well marked in the costal area, and passes just outside the anastomosis, transversely downwards, to meet the third at an angle of about 50°. On this fourth fascia, just before it meets the third, are two distinct blackish spots; below the union of the fascia, and extending to the tornus, is a broad pinkish band,

carrying two small black spots at the tornus itself. All the above fasciæ are formed, as in *Ps. mimica*, of two more or less parallel dark lines placed fairly close together, and enclosing a paler area. The only other markings are an irregular brownish area close to the base, between R and Cu, a series of irregular markings along the dorsum, and indications of an extra fascia lying below the apex of the wing, parallel and close to the termen (as also in *Ps. mimica*). Hindwing quite differently shaped from that of *Ps. mimica*, the base being much narrower, the terminal border cut off straight, and the tornus approaching a right angle; hind border or dorsum slightly excavated. Dark spot somewhat larger than is usual in *Ps. mimica*, less definite in shape, and brownish instead of black.

Abdomen pale brownish, with darker markings, somewhat narrowed basally (apparently much shrunken), enlarged anally. *Appendages* (Plate lxxvii., fig.8) consisting of a pair of superior and a pair of inferior, triangular, valve-like laminæ, partly embracing the terminal segment, but with their apices not meeting together in the middle line.

Type, ♂, in Coll. Tillyard.

Hab.—Booyong, N.S.W., Nov. 1904 (S. W. Jackson). There is also a very damaged specimen in the Queensland Museum, Brisbane, from Mount Tambourine.

This very delicate and graceful species is easily distinguished from all the known species except *Ps. mimica*; the differences which separate it from this latter species have been emphasised in the key and in the description given above.

PSYCHOPSIS ELEGANS (Guérin). (Text-figs.1-3).

Arteriapteryx elegans Guérin, *Iconographie du Règne Animal*, 1845, iii., p.389. Navás, *Congr. Valladolid*, 1916, p.193.

Zygophlebius verrauxinus Navás, *Broteria Braga*, 1910, p.84, fig.23.

Psychopsis mimica Froggatt, *These Proceedings*, 1902, xxvii., p.367.

Psychopsis newmani Froggatt, *These Proceedings*, 1903, p.454, Pl. xxi., figs.1-2. Navás, *Congr. Valladolid*, 1915, p.191.

Type, in Paris Museum.

Hab—Eastern coast of Australia, from Sydney to North Queensland (Cairns, Kuranda, Herberton).

This species is occasionally taken at light, or beaten from bushes, but was considered quite a rarity until Mr. Luke Gallard, of Epping, N.S.W., discovered the larva. Since then, he has succeeded in breeding a number from larvæ found around Epping, and I have bred out nearly two dozen from larvæ taken in various localities, including Hornsby and Berowra, in the Sydney district, Wauchope on the North Coast of New South Wales, Brisbane, Stradbroke Is., Caloundra, Caboolture, Landsborough and Mount Tambourine, in Queensland. Mr. F. P. Dodd has taken the insect at Kuranda and Herberton, N. Queensland.

From larvæ taken on One-tree Hill, Brisbane, under the bark of an Ironbark tree (*Eucalyptus leucoxydon* F.v.M.), I bred both *Ps. elegans* and *Ps. cœlivagus*. There is so little difference between the two larvæ, except in size, that I was not able to distinguish which was which. This seems to me to be a further argument against removing *Ps. cœlivagus* from the genus *Psychopsis*.

PSYCHOPSIS CÆLIVAGUS (Walker).

Hemerobius cœlivagus Walker, Cat. Neuroptera Brit. Mus., 1853, p.279.

Psychopsis cœlivagus Froggatt, These Proceedings, 1903, xxviii., p.455, Pl. xxi., fig.8 (nec Froggatt, *l.c.*, 1902, xxvii., p.368).

Wernzia cœlivaga Navás, Mem. R. Acad. Ci. Art., Barcelona, 1912, x., p.195. Navás, Congr. Valladolid, 1916, p.194.

Type, in British Museum.

Hab.—Queensland coast, from Brisbane to Kuranda and Herberton. A rare species.

This exceedingly striking species is at once distinguished by the remarkable metallic black markings of the forewings, as well as by the pure whiteness of the venation, which gives it a most striking appearance. Some years ago, it was not uncommon on One-tree Hill, Brisbane; but recent severe bush-fires seem almost to have exterminated it.

PSYCHOPSIS INSOLENS McLachlan.

McLachlan, Journ. Entomology, 1866, ii., p.114.

Psychopsis cœliraga Froggatt, These Proceedings, 1902, xxvii, p.367.

Psychopsis insolens Froggatt, *l.c.*, 1902, xxvii., p.367; Froggatt, *l.c.*, 1903, xxvii., p.454, f.6.

Magallanes insolens Navás, Mem. R. Acad. Ci. Art., Barcelona, 1912, x., p.197. Navás, Congr. Valladolid, 1916, p.196.

Type, in British Museum.

Hab.—New South Wales and Queensland; not uncommon. It occurs only sparingly in the Sydney district, but is commoner on the tablelands, particularly on the Queensland border. I have good series from Killarney, also from Mount Tambourine. It has been taken as far north as Herberton (F. P. Dodd). Most of the specimens appear to have been taken at light. Nothing is known of its life-history.

This species is less beautiful than any of the others, but freshly emerged specimens are of a very effective fawn-colour, which fades considerably with age.

PSYCHOPSIS MEYRICKI McLachlan.

McLachlan, Ent. Mo. Mag., 1887, xxiv., p.30.

Magallanes meyricki Navás, Congr. Valladolid, 1915, p.197.

Type, in Coll. McLachlan.

Hab.—Jindabyne, N.S.W., 2,800 feet.

I have not seen this species, of which the unique series of seven specimens taken by Mr. Meyrick on Jan. 20th, 1885, is in the McLachlan Collection. McLachlan gave the habitat as "Kosciusko, 2,800 feet," but this is evidently an error. Mr. Meyrick informs me (*in litt.*) that the specimens were actually taken near Mr. Body's Station at Jindabyne. This latter township is on the main route to Mount Kosciusko, but more than thirty miles from its summit; the Kosciusko Range does not begin to rise from the Monaro Plateau until the junction of the Snowy and Thredbo Rivers is reached, and this is some miles beyond Jindabyne. It seems desirable to point this out, since the type of country in which the insect was taken differs very greatly from that found at higher elevations on the Kosciusko Range.

PSYCHOPSELLA, n.g. (Plate lxxviii., fig.11).

Characters as given in the key on p.771. Small insects, with an expanse of about an inch; the hindwings very much shorter than the fore.

Genotype, *Psychopsella gallardi*, n.sp.

PSYCHOPSELLA GALLARDI, n.sp. (Plate lxxviii., fig.11).

♂. Unique. *Total length*, 7.8 mm.; *abdomen*, 5 mm.; *forewing*, 12.5 mm.; *hindwing*, 9.5 mm.; *expanse*, 24.5 mm.

Head 1.3 mm. wide, pale ochreous; *eyes* dark grey; *antennæ* dull brownish, very short, 1.8 mm.

Thorax: *prothorax* pale ochreous. *Pterothorax* dull brownish, with darker markings. *Legs* very short, with pale ochreous femora, slightly darker tibiæ and tarsi.

Wings: *forewing* with discal and internal gradate series complete, the former consisting of fifteen cross-veins, the latter of nine. Costal series of cross-veins rudimentary, consisting of only about six cross-veins near base, and a single one about half-way along the costal area; marginal series absent. Colouration a very pale ochreous, tessellated all over with slightly darker markings, and here and there small dark brown patches; of these, the most prominent are three sets along the vena triplica, another just beyond the anastomosis, one near the middle of the discal series, two in the marginal area, and some irregular dark markings along Cu. *Hindwing* with short discal and internal gradate series, not complete, the former of six or seven cross-veins, the latter of only four; no marginal series, and only one or two costal cross-veins near base. *No markings at all upon the hindwing*, which is dull whitish and quite transparent.

Abdomen pale ochreous, prettily marked with a mid-dorsal series of dark spots and smaller lateral spots on each segment. *Appendages*: *superior*, a pair of very conspicuous, depressed, sub-triangular processes, laterally flattened, and appearing somewhat forcipate from above; these project well beyond the tip of the abdomen; each one has its apex rounded, and carries near its base, on the outer side, a raised embossment; the whole of the appendage above the embossment, and outwards to the tip,

carries long, curved, whitish hairs. Ventrally, these appendages are separated by a broad, short, trapezoidal *inferior appendage*, whitish in colour (Plate lxxvii., fig.9).

Type, in Coll. Tillyard.

Hab.—The specimen carries no label; but Mr. Gallard, from whom I obtained it, informs me that he bred it from a larva found near Gosford, N.S.W.

At first sight, this species appears to resemble a small specimen of *Ps. insolens*. It may readily be separated from the latter species by the much more delicate build, the much shorter and narrower hindwings, with any markings on them, and the more delicate, paler, narrower, and less strongly marked forewings.

Relationships of the *Psychopsidæ*.

There can be little doubt that the nearest relatives of the *Psychopsidæ* are to be found in the Mesozoic Fossil families *Prohemerobiidæ* and *Kalligrammatidæ*. The former, which very probably represent the original type of the Order Planipennia, are known from the Upper Trias of Ipswich, Queensland, and from the Lias and Upper Jurassic of Europe. The genus *Protopsychopsis* Tillyard, appears to connect the *Prohemerobiidæ* with the *Psychopsidæ* very closely. This relationship has since been further emphasised by the discovery of a second fossil from these beds, differing very little from *Megapsychops illidgei* itself. This fossil will shortly be described by me in Part 5 of my "Mesozoic Insects of Queensland." The differences between the *Psychopsidæ* and the *Prohemerobiidæ* are simply those in which the former family shows specialisation, viz., the enlargement of the costal area, with development of a series of connecting cross-veins, the formation of the vena triplica and anastomosis, and, very probably, the shortening of the antennæ. In all known *Prohemerobiidæ*, the costal space is either quite narrow, or only moderately wide, for its whole width, or only widened at the base; costal veins are never developed; Sc, R, and Rs run close together, but quite separate, to the apex of the wing, without being partially strengthened and separated off to form a vena triplica, as in *Psychopsidæ*; cross-veins appear to be entirely absent from most

species, but may be very weakly indicated between Sc, R, and Rs, and also in the position of the gradate series (these, though shown in my figure of *Protopsychopsis*, are so faintly indicated, that I have been doubtful how far they really existed). The oldest forms of *Prohemerobiidæ* were only of small to moderate size, with only moderately numerous branches of Rs; specialisations in this family appear to have led to the development of forms with an immense number of closely-set branches of Rs. The Upper Jurassic forms are, on the whole, considerably larger than the Liassic forms.

As regards the *Kalligrammatidæ*, these gigantic insects differ from the *Prohemerobiidæ* only in the development of a close series of connecting cross-veins all over the disc; in the beginning of an anastomosis, by connection of Sc with R distally by means of a short cross-vein, very much as in *Psychopsis*; and in the development of the large eye-spots on the wings, recalling those of *Megapsychoptis illidgei*. The rise and fall of this wonderful family was probably very quick; for, if their larvæ, as is probable, were at all like those of *Psychopsis*, they could scarcely have attained to dominance before the rise of the Birds must have quickly exterminated them.

Here let it be noted that *Megapsychoptis illidgei* shows, in the possession of a media with more than two branches, a character that was evidently possessed by the *Kalligrammatidæ* (the true M of this family is labelled Cu by Handlirsch), and by certain of the Liassic *Prohemerobiidæ*, if not by all. Combining this fact with another obvious one, viz., that the development of numerous branches of Rs, occupying a very large area of the wing, is a specialisation confined to the Planipennia, and must, of necessity, have caused a squeezing out and consequent reduction of the media, we are bound to conclude that the ancestors of the Planipennia approached more closely to the Panorpid type, as regards the structure of Rs and M, than they do to-day, and that the many-branched media of *Megapsychoptis illidgei* is an archaic survival that stands to remind us of this fact.

I regard the *Psychopsidæ* as a Mesozoic remnant, considerably isolated, at the present day, from all other existing families. In

order to understand their position, it must be emphasised that they have closest affinity with those groups in which the cross-venation is limited to gradate series, and Sc is not united with R in a *true* anastomosis (*i.e.*, by actual fusion of the two main veins). Thus they show affinity, on the one hand, with the *Hemerobiidae* (s.str.) and *Dilaridae*, but remain more primitive than either of these, on account of the single radial sector of the forewing; while, on the other hand, they are related to the *Trichomatidae*, *Apochrysidæ*, and *Chrysopidæ*. The *Trichomatidæ*, like the *Psychopsidæ*, appear to be a direct offshoot of the old *Prohemerobiidæ*; but their tendency has been towards reduction and narrowing of the wings; whereas that of the *Psychopsidæ* has proceeded in the opposite direction. In the *Apochrysidæ*, we recognise a group of insects with certain characters of the wings strongly suggestive of Psychopsid affinities, *viz.*, the widening of the costal area and the extreme differentiation of the disc. Bearing in mind, however, the slender build and elongated antennæ, and their evident close relationship with the *Chrysopidæ*, I am inclined to regard these venational characters as the result of convergence, rather than of true relationship. Both the *Apochrysidæ* and the *Chrysopidæ* differ radically from the *Psychopsidæ* in the manner of development of the branches of Rs, which tend to cross the wing transversely, and have thus brought about new tendencies in the development of the gradate series, and finally the unique formation of the pseudomedia and pseudocubitus.

The larval form of *Psychopsis* is such that, from it, there can be equally easily derived the small-jawed series of larvæ found in the *Hemerobiidæ*, *Chrysopidæ*, etc., or the long-jawed series of the *Berothidæ* and *Osmylidæ*, or the large-jawed series of the *Nymphidæ*, *Myrmeleontidæ*, etc. In the last series, there has been a gradual addition of internal teeth to the mandible, beginning with one only in *Nymphidæ*, and passing up to three or more in *Myrmeleontidæ*. Hence we shall probably be on safe ground, if we regard the larval type found in *Psychopsis* as closely similar to that of the extinct *Prohemerobiidæ*.

From the *Berothidæ* and *Osmylidæ*, the *Psychopsidæ* are at

once distinguished by the lack of a true anastomosis between Sc and R. The *Berothidae* are clearly a specialisation from the older *Trichomatidae*, the *Osmylidae* from a type resembling the still existing *Polystæchotes*, which, to my mind, will go well enough into the *Berothidae* as at present defined. It should be noted that both palæontological and morphological evidence tends to show that the groups with numerous cross-veins in the disc are of more recent origin than those without; it is only by stressing this point that we can be sure of obtaining a correct view of the Phylogeny of the Planipennia, which are an essential portion of the Panorpid Complex, and originated from more open-veined ancestors.

BIBLIOGRAPHY.

1. BANKS, N., 1910.—“Synonymical Notes on Neuroptera.” Ent. News, Philadelphia, 1910, p.389. (*Zygophlebia* and *Balmes* Navás considered to be synonyms of *Psychopsis* Newman).
2. ———, 1913.—“Synopsis and descriptions of Exotic Neuroptera.” Trans. Amer. Ent. Soc., 1913, xxxix., pp.201-242. (Subfamily *Psychopsine* established on account of the union of Sc, R, and Rs).
3. FROGGATT, 1902.—“Notes on Australian Neuroptera and their Life-Histories.” Proc. Linn. Soc. N. S. Wales, 1902, xxvii., p.358.
4. ———, 1903.—“Notes on the genus *Psychopsis* Newman, with Descriptions of new Species.” *Ibid.*, 1903, xxviii., p.453, Pl. xxi.
5. GUERIN, 1845.—Iconographie du Règne Animal, 1829-1844, iii., p.389. (Description of *Arteriopteryx elegans*).
6. HAGEN, 1867.—“Hemerobidarum Synopsis synonymica.” Stett. ent. Zeit., 1867, p.375. (Characters of the genus *Psychopsis* Newman).
7. McLACHLAN, 1866.—“On some new Species of Neuropterous Insects from Australia and New Zealand, belonging to the Family *Hemero-biidae*.” Journ. Entom., 1866, ii., p.111. (Description of *Ps. insolens*).
8. ———, 1887.—*Psychopsis meyricki*, n.sp. Ent. Mo. Mag., 1887, xxiv., p.30.
9. ———, 1891.—“An Asiatic *Psychopsis*” (*Ps. birmana*, n.sp.). Ent. Mo. Mag., 1891, xxvii., p.320.
10. ———, 1902.—“A second African Species of *Psychopsis*” (*Ps. marshalli* McLach.). Ent. Mo. Mag., 1902, xxxviii., p.234.

11. NAVAS, 1910.—“Hemerobidos nuevos, con la clave de los tribus y géneros de la familia.” *Broteria Braga*, 1910, ix., pp.69-90. (Characters of genera *Zygophlebius* and *Balmes*; description of *Z. verreauxinus*).
12. ———, 1912.—“Insectos Neuropteros nuevos o poco conocidos.” *Mem. R. Acad. Cienc. Art. Barcelona*, 1912, x., No.9, pp.135-202. (P.62, tribe *Psychopsini* defined: p.63, *Weruzia*; and p.65, *Mayallanes*, n.g., characterised).
13. ———, 1916(?)—“Essayo monografico de la familia de los Sicopsidos (Ins. Neur.)” *Asoc. Española para el Prog. de las Ciencias: Congreso de Valladolid*, Oct. 1915, pp.181-210.
14. NEWMAN, 1842.—“Entomological Notes.” *Entomologist*, 1842, pp. 413-415. (Genus *Psychopsis* defined, and type-species, *Ps. mimica*, described).
15. TILLYARD, 1916.—“Studies in Australian Neuroptera,” No. iv. *Proc. Linn. Soc. N. S. Wales*, 1916, xli., pp. 269-332, Pl. xii.-xix. (See pp. 271 and 289).
16. ———, 1917.—“Mesozoic Insects of Queensland,” No.1. *Ibid.*, 1917, xlii., p.178, Pl. viii., fig.3. (Genus *Protopsychopsis* defined, and *Ps. venosa* described).
17. WALKER, 1853.—*Catalogue of the Neuroptera in the British Museum*. 1853, p.279.

Note.—This Bibliography is not intended to be a complete one, but only to list the papers actually mentioned in this work. The references to Australian species are, however, complete.

EXPLANATION OF PLATES LXXVI.-LXXVIII.

Plate lxxvi.

Megapsychops illidgei (Froggatt).

Fig.1.—Venation of forewing of large ♀ in Queensland Museum; (× about $2\frac{1}{2}$).

Fig.2.—Large ♀ in Queensland Museum; (× about $1\frac{1}{2}$).

Fig.3.—Venation of hindwing of same specimen; (× about $2\frac{3}{4}$).

(Photomicrographs of figs.1 and 3 taken by Mr. H. Hacker, Entomologist to the Queensland Museum, and sent by Mr. H. Longman, F.L.S., Director of the Queensland Museum. That of fig.2 sent by Dr. R. Hamlyn Harris, late Director of the same Institution).

Plate lxxvii.

Megasychops illidgei (Froggatt).

Fig.4.—Complete venation of both wings of small ♂ in Coll. Tillyard; ($\times 4$). (Compare with Plate lxxvi., and contrast with Text.fig.1) *tn*, torus; venational notation as in Text-fig.1).

Fig.5.—Appendages of the same ♂, postero-dorsal view; ($\times 11\frac{1}{2}$).

Fig.6.—The same insect, alive, resting upon a flat surface. Dorsal view; ($\times 1\frac{1}{2}$).

Fig.7.—The same insect, alive, resting upon a twig. Lateral view; ($\times 1\frac{1}{2}$).

Psychopsis gracilis, n.sp.

Fig.8.—Appendages of ♂. Postero-dorsal view; ($\times 11\frac{1}{2}$).

Psychopsella gallardi, n.g. et sp.

Fig.9.—Appendages of ♂. Postero-dorsal view; ($\times 27$).

(Figs. 6-7 drawn from pencil-sketches sent by Miss M. Davidson, of Cedar Cottage, Mount Tambourine, Q. The dark colouration is a rich brown, and resembles a fairly thick layer of varnish. In fig.4, the dotted double-arc indicates the external raised edge of the large embossment in the forewing; the dotted oval represents the area covered by the dark spot in the hindwing. In fig.7, the abdomen of the insect is slightly visible through the semitransparent wings).

Plate lxxviii.

Fig.10.—*Psychopsis gracilis*, n.sp., ♂, in Coll. Tillyard; ($\times 4$).

Fig.11.—*Psychopsella gallardi*, n.g. et sp. Unique ♂ in Coll. Tillyard; ($\times 6$).